

Characteristic and origins of "Valuable Water Springs in Toyama Prefecture" using isotopic composition and chemical concertation

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Total eight spots of spring water from Toyama Prefecture were selected as 'The 100 Exquisite and Well-Conserved Waters (EW water)' by Ministry of the Environment in Japan. However, with enhancement of groundwater usage in recent years, water quality and flux diminished gradually. To understand the origins and water qualities of these spring water, we measured hydrogen and oxygen stable isotopes, together with chemical composition of spring water, groundwater, rivers, and rainfall in Toyama Prefecture. All EW water in the Toyama Prefecture lied in the middle of meteoric water line with d-value (δD - $\delta^{18}O$) of 30 in winter and 10 in summer. This suggests that EW water was well-mixed and balanced by precipitation in all seasons. Muratsubaki located in the edge of Kurobe alluvial fan, has very similar mineral composition with nearby confined groundwater, suggests having the same catchment origin with Kurobe River. Using $\delta^{18}O$ and water property data, this spring water is known that originated from high mountain area with 1658m elevation and well forested. Furthermore, downstream show higher SiO_2 and lower Na/Ca ratio relative to upstream, well agreed with longer residence time in the downstream (0-5 yrs) comparable with previous study. In contrast, no significant difference of SiO_2 and Na/Ca versus $\delta^{18}O$ between groundwater and river in the Sho River fan, implying short transit time from river to groundwater. This study highlights the importance to examine groundwater source to sustain high quality EW water, e.g. paying attention to water preservation in the forest area.

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